In the United States Patent and Trademark Office

Appn. Number:_____

Appn. Filed:_____

Applicant(s): Johs eTal.

Appn. Title: ELLIPSOMETER OR POLARIMETER AND THE LIKE SYSTEM

Examiner/GAU: _____ 1324 WITH BEAM CHROMATIK SHIFTING AND DIRECTING MEANS

Mailed: WITH APPLICATION

At:_____

Information Disclosure Statement

Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.

Following are comments on these references pursuant to Rule 98:

IDENTIFIED PATENTS

Patents of which the Inventor is aware include those to:

Woollam et al, No. 5,373,359,
Johs et al. No. 5,666,201
Green et al., No. 5,521,706,
Johs et al., No. 5,504,582

and are disclosed for general information as they pertain to ellipsometer systems.

Further Patents of which the Inventor is aware include:

Nos. 5,757,494 and 5,956,145 to Green et al., in which are taught a method for extending the range of Rotating Analyzer/Polarizer ellipsometer systems to allow measurement of DELTA'S near zero (0.0) and one-hundred-eighty (180) degrees, and the extension of modulator element ellipsometers to PSI'S of forty-five (45) degrees. Said Patents describes the presence of a variable, transmissive, bi-refringent component which is added, and the application thereof during data acquisition to enable the identified capability.

Patent No. 5,706,212 to Thompson et al. is also disclosed as it teaches a mathematical regression based double Fourier series ellipsometer calibration procedure for application,

RE 34,783, 4,373,817, and
5,045,704 to Coates.

Patent to Bjork et al., No. 4,647,207 is disclosed as it describes an ellipsometer system which has provision for sequentially positioning a plurality of reflective polarization state modifiers in a beam of electromagnetic radiation. While said 207 Patent mentions investigating a sample system in a transmission mode, no mention or suggestion is found for utilizing a plurality of transmitting polarization state modifiers. Patent Nos.:

4,210,401;
4,332,476; and
4,355,903;

are also identified as being cited in the 207 Patent. It is noted that systems as disclosed in these Patents, (particularly in the 476 Patent), which utilize reflection form an element to modify a polarization state can, if such an element is an essential duplicate of an investigated sample and is rotated ninety degrees therefrom, the effect of the polarization state modifying element on the electromagnetic beam effect is extinguished by the sample.

Patent to Mansuripur et al., No. 4,838,695 is disclosed as it describes an apparatus for measuring reflectivity.

Patents to Rosencwaig et al., Nos.:

4,750,822; and
5,595,406

are also identified as they describe systems which impinge electromagnetic beams onto sample systems at oblique angles of incidence. The 406 Patent provides for use of multiple wavelengths and multiple angles of incidence. For similar reasons Patent No.:

5,042,951

to Gold et al. is also disclosed.

Patent to Osterberg, No. 2,700,918 describes a microscope with variable means for increasing the visibility of optical images, partially comprised of discrete bi-refringent plates which can be positioned in the pathway between an eyepiece and an observed object. Other Patents identified in a Search which identified said 918 Patent are Nos.:

3,183,763 to Koester;

primarily, in calibrating ellipsometers system utilized in infrared wavelength range. Bi-refringent, transmissive window-like compensators are described as present in the system thereof, and discussion of correlation of retardations entered by sequentially adjacent elements which do not rotate with respect to one another during data acquisition is described therein.

Patent to He et al., No. 5,963,327 is disclosed as it describes an ellipsometer system which enables providing a polarized beam of electromagnetic radiation at an oblique angle-of-incidence to a sample system in a small spot area.

Patent to Johs et al., No. 5,872,630 is disclosed as it describes an ellipsometer system in which an analyzer and polarizer are maintained in a fixed in position during data acquisition, while a compensator is caused to continuously rotate.

Patent to Dill et al., No. 4,953,232 is disclosed as it describes a rotating compensator ellipsometer system.

Patents disclosed as they Claim various Compensator Designs are:

No. 5,946,098 to Johs et al.;
No. 5,963,325 to Johs et al.;
No. 6,084,674 to Johs et al.;
No. 6,084,675 to Herzinger et al.;
No. 6,100,981 to Johs et al.;
No. 6,118,537 to Johs et al.;
No. 6,141,102 to Johs et al.

Patent 4,556,292 to Mathyssek et al. and

Patent No. 5,475,525 to Tournois et al.;

are disclsoed as they were cited in examination of some of the just disclosed Patents.

Patent to Coates et al., No. 4,826,321 is disclosed as it describes applying a reflected monochromatic beam of plane polarized electromagnetic radiation at a Brewster angle of incidence to a sample substrate to determine the thickness of a thin film thereupon. This Patent also describes calibration utilizing two sample substrates, which have different depths of surface coating.

Other Patents which describe use of reflected electromagnetic radiation to investigate sample systems are:

4,105,338 to Kuroha;
3,992,104 to Watanabe;

and a Russian Patent, No. SU 1518728. Said other Patents are not believed to be particularly relevant, however.

Patent No. 5,329,357 to Bernoux et al. is also identified as it Claims use of fiber optics to carry electromagnetic radiation to and from an ellipsometer system which has at least one polarizer or analyzer which rotates during data acquisition. It is noted that if both the polarizer and analyzer are stationary during data acquisition that this Patent is not controlling where electromagnetic radiation carrying fiber optics are present.

Patent No. 6,628,917 to Johs is disclosed as present invention preferred practice is to utilize a spectroscopic source of electromagnetic radiation with a relatively flat spectrum over a large range of wavelengths.

Patent to Chen et al., No. 5,581,350, is disclosed as it describes a method for regression calibration of ellipsometers.

Patent No. 6,608,526 to Piwonka-Corle et al is disclsoed, as is

Patent No. 5,596,411 to Fanton et al.,

as the Applicant is aware thereof.

IDENTIFIED SCIENTIFIC PAPERS

A paper by Johs, titled "Regression Calibration Method for Rotating Element Ellipsometers", Thin Solid Films, 234 (1993) is also disclosed as it describes a mathematical regression based approach to calibrating ellipsometer systems.

Another paper, by Gottesfeld et al., titled "Combined Ellipsometer and Reflectometer Measurements of Surface Processes on Nobel Metals Electrodes", Surface Sci., 56 (1976), is also identified.

A paper by Smith, titled "An Automated Scanning Ellipsometer", Surface Science, Vol. 56, No. 1. (1976), is also mentioned as it describes an ellipsometer system which does not require any moving, (eg. rotating), elements during data acquisition.

Additional papers, by Azzam and Azzam et al. are also identified as concerning alternative approaches to the goal of the present invention, and are titled:

- "Multichannel Polarization State Detectors For Time-Resolved Ellipsometry", Thin Solid Film, 234 (1993); and

- "Spectrophotopolarimeter Based On Multiple Reflections In A Coated Dielectric Slab", Thin Solid Films 313 (1998); and

And two more papers by Azzam et al. are also disclosed:

- "General Analysis And Optimization Of The Four-Detector Photopolarimeter", J. Opt. Soc. Am., A, Vol. 5, No. 5 (May 1988); and

- "Accurate Calibration Of Four-Detector Photopolarimeter With Imperfect Polarization Optical Elements", J. Opt. Soc. Am., Vol. 6, No. 10, (Oct. 1989);

A review paper by Collins, titled "Automatic Rotating Element Ellipsometers: Calibration, Operation and Real-Time Applications", Rev. Sci. Instrum., 61(8) (1990), is identified for general information.

SINCERELY,

JAMES D. WELCH
REG. NO. 31,216

Form PTO-1449 (REV. 7-80) — U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
APPLICANT: John et al	
FILING DATE	GROUP

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	3373385	12/1994	Woodham et al.	356	328	
	AB	5666201	9/1997	John et al.	356	369	
	AC	5552706	5/1996	Green et al.	356	369	
	AD	5504582	4/1996	John et al.	356	369	
	AE	5754945	5/1998	Green et al.	356	369	
	AF	5956145	9/1999	Green et al.	356	364	
	AG	5706212	1/1998	Thompson et al.	356	525	
	AH	RE34728	11/1994	Coater	250	372	
	AI	4373817	2/1983	Coater	356	384	
/	AJ	5045704	9/1991	Coater	250	372	
	AK	4647207	3/1987	Björk et al	356	369	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	AR	
	AS	

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form PTO-1449 (REV. 7-80) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO. | SERIAL NO.

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

APPLICANT: Tahr eTal.

FILING DATE | GROUP

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4 210 410	7/1980	Batten	356	369	
	AB	4 332 476	6/1982	Stenbers etal	356	369	
	AC	4 355 903	10/1982	Sandercock	356	632	
	AD	4 838 695	6/1989	Mansuripur etal.	356	369	
	AE	4 750 822	6/1988	Rosencwaig etal	356	445	
	AF	5 596 406	1/1997	Rosencwaig etal	356	327	
	AG	5 042 951	8/1991	Gold etal.	356	369	
	AH	2 701 098	2/1953	Osterberg etal.			
	AI	3 187 637	5/1965	Hoerter			
	AJ	5 963 327	10/1999	He etal.	356	369	
	AK	5 872 630	2/1999	Tahr etal.	356	369	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		
	AS		

EXAMINER | DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449 (REV. 7-80)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO.	SERIAL NO.
LIST OF PRIOR ART CITED BY APPLICANT *(Use several sheets if necessary)*		APPLICANT: Joh et al.	
		FILING DATE	GROUP

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4053232	10/1977	Dill et al	356	118	
	AB	5946098	8/1999	Joh et al.	356	364	
	AC	5963325	10/1999	Joh et al.	356	364	
	AD	6084674	7/2000	Joh et al.	356	364	
	AE	6084675	7/2000	Herzinger et al.	356	369	
	AF	6100981	8/2000	Joh et al.	356	364	
	AG	6118537	9/2000	Joh et al.	356	369	
	AH	6141102	10/2000	Joh et al.	356	364	
	AI	4556292	12/1985	Mathyssek et al.	350	394	
	AJ	5475525	12/1995	Tournois et al.	359	245	
	AK	4826321	5/1989	Coates et al.	356	351	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	AR	
	AS	

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449 (REV. 7-80) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
APPLICANT Joh, et al.	
FILING ATE	GROUP

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4 105 338	8/1978	Iwuroha	356	118	
	AB	3 992 104	11/1976	Uetanabe	356	117	
	AC	5 329 357	7/1994	Bernoux et al.	356	369	
	AD	6 268 917	7/2001	Joh,	356	369	
	AE	5 558 135	12/1996	Chen et al.	356	369	
	AF	5 608 526	3/1997	Piwonka-Corle et al.	356	369	
	AG	5 596 411	1/1997	Fantoni et al.	356	369	
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION N
	AL	1 518 728		Soviet				
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		
	AS		

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

USCOMM-DC 80-3868

PLEASE USE THE FOLLOWING FOR PTO FORM 1449 FOR ARTICLES

Paper by Johs, titled "Regression Calibration Method for Rotating Element Ellipsometers", Thin Solid Films, 234 (1993).

Paper, by Gottesfeld et al., titled "Combined Ellipsometer and Reflectometer Measurements of Surface Processes on Nobel Metals Electrodes", Surface Sci., 56 (1976).

Paper by Smith, titled "An Automated Scanning Ellipsometer", Surface Science, Vol. 56, No. 1. (1976).

Papers, by Azzam and Azzam et al. are also identified as concerning alternative approaches to the goal of the present invention, and are titled:

"Multichannel Polarization State Detectors For Time-Resolved Ellipsometry", Thin Solid Film, 234 (1993); and

"Spectrophotopolarimeter Based On Multiple Reflections In A Coated Dielectric Slab", Thin Solid Films 313 (1998); and

"General Analysis And Optimization Of The Four-Detector Photopolarimeter", J. Opt. Soc. Am., A, Vol. 5, No. 5 (May 1988); and

"Accurate Calibration Of Four-Detector Photopolarimeter With Imperfect Polarization Optical Elements", J. Opt. Soc. Am., Vol. 6, No. 10, (Oct. 1989); and

"Review paper by Collins, titled "Automatic Rotating Element Ellipsometers: Calibration, Operation and Real-Time Applications", Rev. Sci. Instrum., 61(8) (1990), is identified for general information.